

REMARKS

In the Office Action dated April 18, 2005, affirmation was requested of the restriction requirement promulgated between the inventions of Group I and II. The claims of Group I, claims 1-26 were examined. As to these claims, claims 1-5 and 16-19 were rejected under 35 U.S.C. § 103 as being unpatentable over the Challand 5,641,015 patent in view of the Pineda et al. 6,551,396 patent (Pineda). Claims 6-15 and 20-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Challand in view of the Carter et al. 2,968,848 patent (Carter) and Pineda in further view of the Sahari 5,158,130 patent or the Conroy et al. 5,915,452 patent (Conroy). For the reasons outlined in detail below, it is respectfully submitted that the pending claims are patentable over the art of record.

Applicant takes this opportunity to affirm the election of the claims of Group I, claims 1-26, for prosecution herein. Claims 27-46, the claims of Group II, have been cancelled without prejudice to their reintroduction in a divisional application.

The Examiner is thanked for the courtesy of providing an interview to applicant's attorney and two of the inventors on July 5, 2005. During the interview, independent claim 1 was discussed, together with the references of record, particularly Challand and Carter.

Enclosed is a Section 132 Declaration of one of the co-inventors, Dr. John Campbell. The Section 132 Declaration of Dr. Campbell notes that he is the author of several textbooks on casting and has been in the casting industry for a significant number of years. He currently holds the post of Emeritus Professor at the University of Birmingham in the United Kingdom and was previously the Professor of Casting Technology at the University of Birmingham. He has published about 150 papers on liquid metals, solidification and casting technology. In sum, he is an expert in the field.

In the Office Action, claims 1-5 and 16-19 were rejected as being unpatentable over the combination of Challand, Carter and Pineda.

Challand was employed in the Office Action for its asserted teaching of a process for casting metals using a water dispersible mold "for the purpose of easily removing moving (sic) the casting from the mold after the casting (column 9, lines 45+) with water". Water dispersible molds, such as the mold illustrated in Challand, are known. Challand teaches that the fine particulate refractory material used together with

foundry sand and a binder results in improvements in the strength of the mold when it is hot, prior to casting. Challand particularly notes that the removal of the mold after casting can be carried out by soaking the casting in a water bath and then flushing the casting with water (see column 9, lines 45-47). However, as noted during the interview, completely solidifying the cast metal before removal of the mold is assumed in Challand and is standard practice in the industry (see paragraph 14 of the Declaration of Dr. Campbell). There is no teaching or disclosure in Challand of removing at least a portion of the mold, wherein the step of removing the mold begins before the step of solidifying the molten metal has been completed, as recited in claim 1.

It was pointed out during the interview that Carter particularly teaches the immersion of its shell mold 20 into its bath 22 "until the molten metal therein solidifies and preferably for some time interval thereafter", since this "is important in the practice of the invention" (see column 3, lines 48-51). It was also noted that Carter particularly teaches that his shell "must be self supporting in the sense that it can be moved into the liquid coolant" (see column 4, lines 32-34). Carter further teaches that his poured mold, with the metal in it still in a fluid condition, should be immersed in the body of liquid 22 and that it should be maintained in the liquid until the molten metal solidifies (see column 3, lines 26-27). The purpose given in Carter for immersing molten metal, held in a mold, in a liquid bath is that the bath has very high heat transfer properties. Carter particularly notes that the liquid used as a coolant "acts essentially to conduct heat away from the mold and establish a controlled cooling rate" (see column 2, lines 61-63). Thus, cooling in Carter takes place through the mold.

There is no teaching in Carter that the mold is removed during the process of solidifying the molten metal into a casting. It is respectfully submitted that Carter fails to teach the step of removing at least a part of the mold, prior to complete solidification of the molten metal into a casting, as is recited in claim 1.

Pineda is similarly deficient. In the Office Action, it was contended that Pineda teaches the use of dropping a mold into water in order to remove or crack a portion of the water dispersible mold.

However, as with Carter, there is no teaching or disclosure in Pineda of a process for casting the metals wherein the step of removing the mold begins before the step of solidifying the molten metal has been completed. Pineda particularly discusses

the use of the mold to obtain a casting. Only after the casting has cooled, and only after the mold itself is allowed to cool (see column 6, line 24), is the mold removed. Such removal is by grinding, sand blasting or the like (see column 6, line 25). Pineda particularly teaches sand blasting with glass beads (see column 6, lines 27-28). Alternatively, as noted in the Office Action, Pineda teaches dropping the mold into water to create a heat differential between the inner and outer surfaces to crack the mold (see column 6, lines 29-31). What is clearly missing from Pineda, as it was from Challand and Carter, is any teaching or disclosure of removing at least a part of the mold prior to complete solidification of the molten metal in the mold into a casting.

Therefore, even the asserted combination of Challand, Carter and Pineda neither teaches nor discloses a process for the casting of metals in which at least a portion of the mold is removed, wherein the step of removing the mold begins before the step of solidifying the molten metal has been completed. Accordingly, as discussed during the interview, claim 1 patentably defines over the asserted combination of references, as well as the remainder of the cited art.

Dependent claims 2-5 merely further patentably define the detailed subject matter of their parent claim. As such, these claims are also in condition for allowance over the art of record.

Dependent claims 6-15 were rejected as being unpatentable over Challand, Carter and Pineda and in further view of Sahari or Conroy. Sahari was used for its teaching of nozzles and submerging the mold into water and separating the molding granules from binder for the purpose of cooling and removing the casting from the mold and for reusing the binder. Conroy was said to teach the use of nozzles and particular flow rates and pressures of fluids, including water and surfactant, for the purpose of removing cores from castings. It was stated that it would have been obvious to one having ordinary skill in the art to provide Challand, in view of Carter and Pineda, with water nozzles or the reuse of binders as taught by either Pineda, Sahari or Conroy.

As mentioned during the interview, the two additional references to Sahari and Conroy do not supply those teachings which are clearly absent from Challand, Carter and Pineda. More particularly, neither Sahari nor Conroy teaches or discloses a process for the casting of metals, wherein at least a portion of the mold is removed, wherein the step of removing the mold begins before the step of solidifying the molten

metal has been completed. Sahari particularly teaches that after the cast metal or metal alloy has crystallized, then the mold and any core can be disassembled (see column 6, lines 11-12). Similarly, in Conroy, the teaching is to the removal of ceramic cores from turbine blade investment castings (see column 3, lines 24-26) after the castings have completely solidified. Neither of these patents contemplate that one could remove at least a portion of the mold before the molten metal has completely solidified into a casting (see paragraph 17 of Dr. Campbell's Declaration).

In view of the foregoing, it is respectfully submitted that dependent claims 6, 7, 9, 10 and 12-15, which merely further patentably define the detailed subject matter of their parent claim or each other, are also in condition for allowance over the applied five way combination, as well as the remainder of the cited art. Dependent claims 8 and 11 have been cancelled without prejudice.

Independent claim 16 was similarly rejected over the three way combination of Challand, Carter and Pineda. Claim 16 recites a process for reducing the cooling time of a metal that has been cast, comprising the steps of providing a mold, supplying molten metal to the mold, spraying the mold with a solvent, decomposing at least a portion of the mold with the solvent and cooling the molten metal with the solvent, wherein the step of spraying commences before the molten metal has completely solidified. As discussed during the interview, there is no teaching or disclosure of the process of claim 16 in the applied combination of Challand, Carter and Pineda. More particularly, none of Challand, Carter or Pineda, in any combination, discloses or teaches a process for reducing the cooling time of a metal which has been cast, including spraying the mold with a solvent and cooling the molten metal with the solvent, wherein the step of spraying commences before the molten metal has completely solidified. Accordingly, claim 16 is patentable over the applied three way combination, as well as the remainder of the cited art.

Claims 18-19 were rejected on the same grounds. Since these claims merely further patentably define the detailed subject matter of their parent claim, they too are believed to be in condition for allowance over the art of record. Dependent claim 17 has been cancelled without prejudice.

Dependent claims 20-26 were rejected as being unpatentable over Challand, Carter and Pineda in further view of Sahari or Conroy. However, even the applied five

way combination neither teaches nor discloses a process for reducing the cooling time of a metal that has been cast, comprising the steps of spraying the mold with a solvent and cooling the molten metal with the solvent, wherein the step of spraying commences before the molten metal has completely solidified. It is respectfully submitted that there is no teaching or disclosure in even the applied five way combination of such a process, for the reasons detailed above. As such, it is respectfully submitted that claims 20-23, 25 and 26 are in condition for allowance over the art of record. Claim 24 has been cancelled without prejudice.

As mentioned, claims 27-46 have been cancelled without prejudice to their reintroduction in a divisional application.

Applicant submits herewith a new set of claims 47-53. As discussed during the interview, claim 47 is an independent claim which recites a process for the casting of an aluminum metal comprising providing a mold, delivering a molten aluminum metal into the mold and decomposing at least a portion of the mold at an elevated temperature with a solvent including water, wherein the step of decomposing at least a portion of the mold begins before the molten aluminum metal has completely solidified into a casting.

As mentioned in Dr. Campbell's Declaration, it is highly surprising that such a process works and does not lead to explosions because the oxygen in water reacts violently with molten aluminum (see paragraph 8 of the Campbell Declaration). There is no teaching or disclosure of such a process in the applied five references to Challand, Carter, Pineda, Sahari or Conroy. The counter-intuitive nature of the process for casting recited in claim 47 was noted during the interview. Quite simply, none of the five references applied even contemplates that such a process is possible.

The conventional wisdom concerning molten aluminum and water can be seen in the Niedling and Ekenes et al. articles which were submitted to the Examiner in a Third Supplemental Information Disclosure Statement as documents AS and AT. The Third Supplemental Information Disclosure Statement was filed on July 6, 2005. During the interview, the Examiner questioned whether it was well known to those in the art that water when contacting molten aluminum would cause explosions. Applicants promised to submit some articles on this point. That is the reason why these two articles were submitted in the Third Supplemental Information Disclosure Statement. As explained during the interview, it is crystal clear to those working in the art that molten aluminum

and water have to be kept far apart because of the risk of a violent reaction.

In sum, the process of claim 47 is highly inventive and is counter to the conventional teaching of the industry. Therefore, it is respectfully submitted that claim 47 is in patentable condition over the applied references, as well as the remainder of references of record.

Dependent claims 48-53 merely further patentably define the detailed subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

Applicant herewith submits a second new set of claims 54-61. Claim 54 is the independent claim. It recites a process for reducing the cooling time of a metal that has been cast comprising providing a mold, supplying a molten metal, including aluminum, to the mold to form a cast metal, percolating a solvent, including water, through the mold to the cast metal, forming a relatively solid skin on the cast metal while an interior thereof remains molten and subsequently contacting the relatively solid skin on the cast metal with the solvent.

Support for this claim can be found on pages 7 and 8 of the instant specification. It is there stated that the rate and pressure of delivery of jet A are of a setting that is high enough to decompose the mold 36 yet low enough to allow the solvent to percolate through the mold 36, so that percolated solvent arrives at the cast metal 33 ahead of the full force of the jet A. In this manner, percolated solvent causes the formation of a relatively solid skin on the cast metal 33 before the metal 33 is contacted by the force of the jet A, thereby preventing distortion of the metal 33 or explosion from excessive direct contact of the solvent with the molten metal (see the instant specification, page 7, line 24 to page 8, line 1).

It is respectfully submitted that there is no teaching or disclosure in the five applied references of Challand, Carter, Pineda, Sahari or Conroy, even in combination, of the process recites in claim 54. None of the references even mentions the forming of a relatively solid skin on cast metal while an interior thereof remains molten and subsequently cooling the relatively solid skin on the cast metal with a solvent. Much less, is there any teaching or disclosure of a molten metal, including aluminum, and a solvent, including water. As discussed during the interview, claim 54 is in condition for allowance over all of the applied references, as well as the remainder of the art of

record.

Dependent claims 55-61 merely further patentably define the detailed subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

Finally, applicant submits herewith a new claim set 62-70. Claim 62 is independent. It recites a method for removing a mold from a casting which is being formed therein, comprising directing a fluid stream at the mold when the casting is partially solidified and dislodging at least a portion of the mold from the casting.

Applicant notes that independent claim 62 is similar to claim 44 of U.S. Patent Application Serial No. 10/616,750 of Lewis et al. That application was published as Publication No. 2004/0055728.

It is respectfully submitted that claim 62 patentably defines over the applied five references, as well as the remainder of the cited art. More particularly, none of the references teaches or discloses a method of removing a mold from a casting which is being formed therein, wherein a fluid stream is directed at the mold when the casting is partially solidified and wherein at least a portion of the mold is dislodged from the casting at a time before the casting has completely solidified, i.e., when the casting is only partially solidified. As discussed during the interview, claim 62 recites that at least a portion of the mold is dislodged via a fluid stream when the casting is only partially solidified. Such a method of removing a mold from a casting is highly inventive. As mentioned, none of the references even consider the possibility of dislodging at least a portion of the mold while the casting is still only partially solidified. Accordingly, claim 62 patentably defines over the applied references, as well as the remainder of the cited art.

Dependent claims 63-70 merely further patentably define the detailed subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over all of the art of record.


In view of the foregoing, it is respectfully submitted that independent claim 1 and its dependent claims 2-7, 9, 10 and 12-15; independent claim 16 and its dependent claims 18-23, 25 and 26; independent claim 47 and its dependent claims 48-53; independent claim 54 and its dependent claims 55-61; and, independent claim 62 and

its dependent claims 63-70 patentably define over the art of record. Allowance of these claims is earnestly solicited.

Respectfully submitted,

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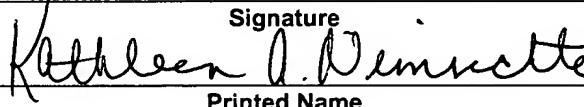
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